FIG. 5A

Alcaligenes (Deleya) aquamarinus Catalase - 64CA2

(SEQ ID NO: 5)
(SEQ ID NO: 6)

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1    ATG AAT AAC GCA TCC GCT GAC GAT CTA CAC AGT AGC TTG CAG CAA AGA TGC AGA GCA TTT  60
1    Met Asn Asn Ala Ser Ala Asp Asp Leu His Ser Ser Leu Gln Gln Arg Cys Arg Ala Phe  20

61   GTT CCC TTG GTA TCG CCA AGG CAT AGA GCA ATA AGG GAG AGA GCT ATG AGC GGT AAA TGT 120
21   Val Pro Leu Val Ser Pro Arg His Arg Ala Ile Arg Glu Arg Ala Met Ser Gly Lys Cys  40

121  CCT GTC ATG CAC GGT GGT AAC ACC TCG ACC GGT ACT TCC AAC AAA GAT TGG TGG CCG GAA 180
41   Pro Val Met His Gly Gly Asn Thr Ser Thr Gly Thr Ser Asn Lys Asp Trp Trp Pro Glu  60

181  GGG TTG AAC CTG GAT ATT TTG CAT CAG CAA GAT CGC AAA TCA GAC CCG ATG GAT CCG GAT 240
61   Gly Leu Asn Leu Asp Ile Leu His Gln Gln Asp Arg Lys Ser Asp Pro Met Asp Pro Asp  80

241  TTC AAC TAC CGT GAA GAA GTA CGC AAG CTC GAT TTC GAC GCG CTG AAG AAA GAT GTC CAC 300
81   Phe Asn Tyr Arg Glu Glu Val Arg Lys Leu Asp Phe Asp Ala Leu Lys Lys Asp Val His 100

301  GCG TTG ATG ACC GAT AGC CAA GAG TGG TGG CCC GCT GAC TGG GGG CAC TAC GGC GGT TTG 360
101  Ala Leu Met Thr Asp Ser Gln Glu Trp Trp Pro Ala Asp Trp Gly His Tyr GLy Gly Leu 120

361  ATG ATC CGT ATG GCT TGG CAC TCC GCT GGC ACC TAC CGT ATT GCT GAT GGC CGT GGG GGC 420
121  Met Ile Arg Met Ala Trp His Ser Ala Gly Thr Tyr Arg Ile Ala Asp Gly Arg Gly Gly 140

421  GGT GGT ACC GGA AGC CAG CGC TTT GCA CCG CTC AAC TCC TGG CCG GAC AAC GTC AGC CTG 480
141  Gly Gly Thr Gly Ser Gln Arg Phe Ala Pro Leu Asn Ser Trp Pro Asp Asn Val Ser Leu 160

481  GAT AAA GCG CGC CGT CTG CTG TGG CCG ATC AAG AAG AAG TAC GGC AAC AAA ATC AGC TGG 540
161  Asp Lys Ala Arg Arg Leu Leu Trp Pro Ile Lys Lys Lys Tyr Gly Asn Lys Ile Ser Trp 180

541  GCA GAC CTG ATG ATT CTG GCT GGC ACC GTG GCT TAT GAG TCC ATG GGC TTA CCT GCT TAC 600
181  Ala Asp Leu Met Ile Leu Ala Gly Thr Val Ala Tyr Glu Ser Met Gly Leu Pro Ala Tyr 200

601  GGC TTC TCT TTC GGC CGC GTC GAT ATT TGG GAA CCC GAA AAA GAT ATC TAC TGG GGT GAC 660
201  Gly Phe Ser Phe Gly Arg Val Asp Ile Trp Glu Pro Glu Lys Asp Ile Tyr Trp Gly Asp 220
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FIG 5B

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661  GAA AAA GAG TGG CTG GCA CCT TCT GAC GAA CGC TAC GGC GAC GTG AAC AAG CCA GAG ACC 720
221  Glu Lys Glu Trp Leu Ala Pro Ser Asp Glu Arg Tyr Gly Asp Val Asn Lys Pro Glu Thr 240

721  ATG GAA AAC CCG CTG GCG GCT GTC CAA ATG GGT CTG ATC TAT GTG AAC CCG GAA GGT GTT 780
241  Met Glu Asn Pro Leu Ala Ala Val Gln Met Gly Leu Ile Tyr Val Asn Pro Glu Gly Val 260

781  AAC GGC CAC CCT GAT CCG CTG AGA ACC GCA CAG CAG GTA CTT GAA ACC TTC GCC CGT ATG 840
261  Asn Gly His Pro Asp Pro Leu Arg Thr Ala Gln Gln Val Leu Glu Thr Phe Ala Arg Met 280

841  GCG ATG AAC GAC GAA AAA ACC GCA GCC CTC ACA GCT GGC GGC CAC ACC GTC GGT AAT TGT 900
281  Ala Met Asn Asp Glu Lys Thr Ala Ala Leu Thr Ala Gly Gly His Thr Val Gly Asn Cys 300

901  CAC GGT AAT GGC AAT GCC TCT GCG TTA GCC CCT GAC CCA AAA GCC TCT GAC GTT GAA AAC 960
301  His Gly Asn Gly Asn Ala Ser Ala Leu Ala Pro Asp Pro Lys Ala Ser Asp Val Glu Asn 320

961  CAG GGC TTA GGT TGG GGC AAC CCC AAC ATG CAG GGC AAG GCA AGC AAC GCC GTG ACC TCG 1020
321  Gln Gly Leu Gly Trp Gly Asn Pro Asn Met Gln Gly Lys Ala Ser Asn Ala Val Thr Ser  340

1021 GGT ATC GAA GGT GCT TGG ACC ACC AAC CCC ACG AAA TTC GAT ATG GGC TAT TTC GAC CTG 1080
341  Gly Ile Glu Gly Ala Trp Thr Thr Asn Pro Thr Lys Phe Asp Met Gly Tyr Phe Asp Leu  360

1081 CTG TTC GGC TAC AAT TGG GAA CTG AAA AAG AGT CCT GCC GGT GCC CAC CAT TGG GAA CCG 1140
361  Leu Phe Gly Tyr Asn Trp Glu Leu Lys Lys Ser Pro Ala Gly Ala His His Trp Glu Pro  380

1141 ATT GAC ATC AAA AAG GAA AAC AAG CCG GTT GAC GCC AGC GAC CCC TCT ATT CGC CAC AAC 1200
381  Ile Asp Ile Lys Lys Glu Asn Lys Pro Val Asp Ala Ser Asp Pro Ser Ile Arg His Asn  400

1201 CCG ATC ATG ACC GAT GCG GAT ATG GCG ATA AAG GTA AAT CCG ACC TAT CGC GCT ATC TGC 1260
401  Pro Ile Met Thr Asp Ala Asp Met Ala Ile Lys Val Asn Pro Thr Tyr Arg Ala Ile Cys  420

1261 GAA AAA TTC ATG GCC GAT CCT GAG TAC TTC AAG AAA ACT TTC GCG AAG GCG TGG TTC AAG 1320
421  Glu Lys Phe Met Ala Asp Pro Glu Tyr Phe Lys Lys Thr Phe Ala Lys Ala Trp Phe Lys  440

1321 CTG ACG CAC CGT GAC CTG GGC CCG AAA TCA CGT TAC ATC GGC CCG GAA GTG CCG GCA GAA 1380
441  Leu Thr His Arg Asp Leu Gly Pro Lys Ser Arg Tyr Ile Gly Pro Glu Val Pro Ala Glu  460
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FIG. 5C

1381 GAC CTG ATT TGG CAA GAC CCG ATT CCG GCA GGT AAC ACC GAC TAC TGC GAA GAA GTG GTC 1440
461 Asp Leu Ile Trp Gln Asp Pro Ile Pro Ala Gly Asn Thr Asp Tyr Cys Glu Glu Val Val 480

1441 AAG CAG AAA ATT GCA CAA AGT GGC CTG AGC ATT AGT GAG ATG GTC TCC ACC GCT TGG GAC 1500
481 Lys Gln Lys Ile Ala Gln Ser Gly Leu Ser Ile Ser Glu Met Val Ser Thr Ala Trp Asp 500

1501 AGT GCC CGT ACT TAT CGC GGT TCC GAT ATG CGC GGC GGT GCT AAC GGT GCC CGC ATT CGC 1560
501 Ser Ala Arg Thr Tyr Arg Gly Ser Asp Met Arg Gly Gly Ala Asn Gly Ala Arg Ile Arg 520

1561 TTG GCC CCA CAG AAC GAG TGG CAG GGC AAC GAG CCG GAG CGC CTG GCG AAA GTG CTG AGC 1620
521 Leu Ala Pro Gln Asn Glu Trp Gln Gly Asn Glu Pro Glu Arg Leu Ala Lys Val Leu Ser 540

1621 GTC TAC GAG CAG ATC TCT GCC GAC ACC GGC GCT AGC ATC GCG GAC GTG ATC GTT CTG GCC 1680
541 Val Tyr Glu Gln Ile Ser Ala Asp Thr Gly Ala Ser Ile Ala Asp Val Ile Val Leu Ala 560

1681 GGT AGC GTA GGC ATC GAG AAA GCC GCG AAA GCA GCA GGT TAC GAT GTG CGC GTT CCC TTC 1740
561 Gly Ser Val Gly Ile Glu Lys Ala Ala Lys Ala Ala Gly Tyr Asp Val Arg Val Pro Phe 580

1741 CTG AAA GGC CGT GGC GAT GCG ACC GCC GAG ATG ACC GAC GCA GAC TCC TTC GCA CCG CTG 1800
581 Leu Lys Gly Arg Gly Asp Ala Thr Ala Glu Met Thr Asp Ala Asp Ser Phe Ala Pro Leu 600

1801 GAG CCG CTG GCC GAT GGC TTC CGC AAC TGG CAG AAG AAA GAG TAT GTG GTG AAG CCG GAA 1860
601 Glu Pro Leu Ala Asp Gly Phe Arg Asn Trp Gln Lys Lys Glu Tyr Val Val Lys Pro Glu 620

1861 GAG ATG CTG CTG GAT CGT GCG CAG CTG ATG GGC TTA ACC GGC CCG GAA ATG ACC GTG CTG 1920
621 Glu Met Leu Leu Asp Arg Ala Gln Leu Met Gly Leu Thr Gly Pro Glu Met Thr Val Leu 640

1921 CTG GGC GGT ATG CGC GTA CTG GGC ACC AAC TAT GGT GGC ACC AAA CAC GGC GTA TTC ACC 1980
641 Leu Gly Gly Met Arg Val Leu Gly Thr Asn Tyr Gly Gly Thr Lys His Gly Val Phe Thr 660

1981 GAT TGT GAA GGC CAG TTG ACC AAC GAC TTT TTT GTG AAC CTG ACC GAT ATG GGG AAC AGC 2040
661 Asp Cys Glu Gly Gln Leu Thr Asn Asp Phe Phe Val Asn Leu Thr Asp Met Gly Asn Ser 680

2041 TGG AAG CCG GTA GGT AGC AAC GCC TAC GAA ATC CGC GAC CGC AAG ACC GGT GCC GTG AAG 2100
681 Trp Lys Pro Val Gly Ser Asn Ala Tyr Glu Ile Arg Asp Arg Lys Thr Gly Ala Val Lys 700

FIG. 5D

2101	TGG	ACC	GCC	TCG	CGG	GTG	GAT	CTG	GTA	TTT	GGT	TCC	AAC	TCG	CTA	CTG	CGC	TCT	TAC	GCA	2160
701	Trp	Thr	Ala	Ser	Arg	Val	Asp	Leu	Val	Phe	Gly	Ser	Asn	Ser	Leu	Leu	Arg	Ser	Tyr	Ala	720
2161	GAA	GTG	TAC	GCC	CAG	GAC	GAT	AAC	GGC	GAG	AAG	TTC	GTC	AGA	GAC	TTC	GTC	GCC	GCC	TGG	2220
721	Glu	Val	Tyr	Ala	Gln	Asp	Asp	Asn	Gly	Glu	Lys	Phe	Val	Arg	Asp	Phe	Val	Ala	Ala	Trp	740
2221	ACC	AAA	GTG	ATG	AAC	GCC	GAC	CGT	TTC	GAC	GTC	GCG	TCG	TAA	2262						
741	Thr	Lys	Val	Met	Asn	Ala	Asp	Arg	Phe	Asp	Val	Ala	Ser	End	754						

FIG. 6A

Microscilla furvescens Catalase - 53CA1

(SEQ ID NO:7)
(SEQ ID NO:8)

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1    ATG GAA AAT CAC AAA CAC TCA GGA TCT TCT ACG TAT AAC ACA AAC ACT GGC GGA AAA TGC   60
1    Met Glu Asn His Lys His Ser Gly Ser Ser Thr Tyr Asn Thr Asn Thr Gly Gly Lys Cys   20

61   CCT TTT ACC GGA GGT TCG CTT AAG CAA AGT GCA GGT GGC GGC ACC AAA AAC AGG GAT TGG 120
21   Pro Phe Thr Gly Gly Ser Leu Lys Gln Ser Ala Gly Gly Gly Thr Lys Asn Arg Asp Trp  40

121 TGG CCC AAC ATG CTC AAC CTC GGC ATC TTA CGC CAA CAT TCA TCG CTA TCG GAC CCA AAC 180
41   Trp Pro Asn Met Leu Asn Leu Gly Ile Leu Arg Gln His Ser Ser Leu Ser Asp Pro Asn  60

181 GAC CCG GAT TTT GAC TAT GCC GAA GAG TTT AAG AAG CTA GAT CTG GCA GCG GTT AAA AAG 240
61   Asp Pro Asp Phe Asp Tyr Ala Glu Glu Phe Lys Lys Leu Asp Leu Ala Ala Val Lys Lys  80

241 GAC CTG GCA GCG CTA ATG ACA GAT TCA CAG GAC TGG TGG CCA GCA GAT TAC GGT CAT TAT 300
81   Asp Leu Ala Ala Leu Met Thr Asp Ser Gln Asp Trp Trp Pro Ala Asp Tyr Gly His Tyr 100

301 GGC CCC TTC TTT ATA CGC ATG GCG TGG CAC AGC GCC GGC ACC TAC CGT ATC GGT GAT GGC 360
101 Gly Pro Phe Phe Ile Arg Met Ala Trp His Ser Ala Gly Thr Tyr Arg Ile Gly Asp Gly 120

361 CGT GGT GGC GGT GGC TCC GGC TCA CAG CGC TTC GCG CCT CTC AAT AGC TGG CCA GAC AAT 420
121 Arg Gly Gly Gly Gly Ser Gly Ser Gln Arg Phe Ala Pro Leu Asn Ser Trp Pro Asp Asn 140

421 GCC AAT CTG GAT AAA GCA CGC TTG CTT CTT TGG CCC ATC AAA CAA AAA TAC GGT CGA AAA 480
141 Ala Asn Leu Asp Lys Ala Arg Leu Leu Leu Trp Pro Ile Lys Gln Lys Tyr Gly Arg Lys 160

481 ATC TCC TGG GCG GAT CTA ATG ATA CTC ACA GGA AAC GTA GCT CTG GAA ACT ATG GGC TTT 540
161 Ile Ser Trp Ala Asp Leu Met Ile Leu Thr Gly Asn Val Ala Leu Glu Thr Met Gly Phe 180

541 AAA ACT TTT GGT TTT GCA GGT GGC AGA GCA GAT GTA TGG GAG CCT GAA GAA GAT GTA TAC 600
181 Lys Thr Phe Gly Phe Ala Gly Gly Arg Ala Asp Val Trp Glu Pro Glu Glu Asp Val Tyr 200

601 TGG GGA GCA GAA ACC GAA TGG CTG GGA GAC AAG CGC TAT GAA GGT GAC CGA GAG CTC GAA 660
201 Trp Gly Ala Glu Thr Glu Trp Leu Gly Asp Lys Arg Tyr Glu Gly Asp Arg Glu Leu Glu 220
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FIG. 6B

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661  AAT CCC CTG GGA GCC GTA CAA ATG GGA CTC ATC TAT GTA AAC CCC GAA GGA CCC AAC GGC  720
221  Asn Pro Leu Gly Ala Val Gln Met Gly Leu Ile Tyr Val Asn Pro Glu Gly Pro Asn Gly  240

721  AAG CCA GAC CCT ATC GCT GCT GCG CGT GAT ATT CGT GAG ACT TTT GGC CGA ATG GCA ATG  780
241  Lys Pro Asp Pro Ile Ala Ala Ala Arg Asp Ile Arg Glu Thr Phe Gly Arg Met Ala Met  260

781  AAT GAC GAA GAA ACC GTG GCT CTC ATA GCG GGT GGA CAC ACC TTC GGA AAA ACC CAT GTT  840
261  Asn Asp Glu Glu Thr Val Ala Leu Ile Ala GlY Gly His Thr Phe Gly Lys Thr His Gly  280

841  GCT GCC GAT GCG GAG AAA TAT GTG GGC CGA GAG CCT GCC GCC GCA GGT ATT GAA GAA ATG  900
281  Ala Ala Asp Als Glu Lys Tyr Val Gly Arg Glu Pro Ala Ala Ala Gly Ile Glu Glu Met  300

901  AGC CTG GGG TGG AAA AAC ACC TAC GGC ACC GGA CAC GGT GCG GAT ACC ATC ACC AGT GGA  960
301  Ser Leu Gly Trp Lys Asn Thr Tyr Gly Thr Gly His Gly Ala Asp Thr Ile Thr Ser Gly  320

961  CTA GAA GGC GCC TGG ACC AAG ACC CCT ACT CAA TGG AGC AAT AAC TTT TTT GAA AAC CTC 1020
321  Leu Glu Gly Ala Trp Thr Lys Thr Pro Thr Gln Trp Ser Asn Asn Phe Phe Glu Asn Leu  340

1021 TTT GGT TAC GAG TGG GAG CTT ACC AAA AGT CCA GCT GGA GCT TAT CAG TGG AAA CCA AAA 1080
341  Phe Gly Tyr Glu Trp Glu Leu Thr Lys Ser Pro Ala Gly Ala Tyr Gln Trp Lys Pro Lys  360

1081 GAC GGT GCC GGG GCT GGC ACC ATA CCG GAT GCA CAT GAT CCC AGC AAG TCG CAC GCT CCA 1140
361  Asp Gly Ala Gly Ala Gly Thr Ile Pro Asp Ala His Asp Pro Ser Lys Ser His Ala Pro  380

1141 TTT ATG CTC ACT ACG GAC CTG GCG CTG CGC ATG GAC CCT GAT TAC GAA AAA ATT TCT CGA 1200
381  Phe Met Leu Thr Thr Asp Leu Ala Leu Arg Met Asp Pro Asp Tyr Glu Lys Ile Ser Arg  400

1201 CGG TAC TAT GAA AAC CCT GAT GAG TTT GCA GAT GCT TTC GCG AAA GCA TGG TAC AAA CTG 1260
401  Arg Tyr Tyr Glu Asn Pro Asp Glu Phe Ala Asp Ala Phe Ala Lys Ala Trp Tyr Lys Leu  420

1261 ACA CAC AGA GAT ATG GGA CCA AAG GTG CGC TAC CTG GGA CCA GAA GTG CCT CAG GAA GAC 1320
421  Thr His Arg Asp Met Gly Pro Lys Val Arg Tyr Leu Gly Pro Glu Val Pro Gln Glu Asp  440

1321 CTC ATC TGG CAA GAC CCT ATA CCA GAT GTA AGC CAT CCT CTT GTA GAC GAA AAC GAT ATT 1380
441  Leu Ile Trp Gln Asp Pro Ile Pro Asp Val Ser His Pro Leu Val Asp Glu Asn Asp Ile  460
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FIG. 6C

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1381 GAA GGC CTA AAA GCC AAA ATC CTG GAA TCG GGA CTG ACG GTA AGC GAG CTG GTA AGC ACG 1440
461  Glu Gly Leu Lys Ala Lys Ile Leu Glu Ser Gly Leu Thr Val Ser Glu Leu Val Ser Thr  480

1441 GCA TGG GCT TCT GCA TCT ACT TTT AGA AAC TCT GAC AAG CGC GGC GGT GCC AAC GGT GCA 1500
481  Ala Trp Ala Ser Ala Ser Thr Phe Arg Asn Ser Asp Lys Arg Gly Gly Ala Asn Gly Ala  500

1501 CGT ATA CGA CTG GCC CCA CAA AAA GAC TGG GAA GTA AAC AAC CCT CAG CAA CTT GCC AGG 1560
501  Arg Ile Arg Leu Ala Pro Gln Lys Asp Trp Glu Val Asn Asn Pro Gln Gln Leu Ala Arg  520

1561 GTA CTC AAA ACA CTA GAA GGT ATC CAG GAG GAC TTT AAC CAG GCG CAA TCA GAT AAC AAA 1620
521  Val Leu Lys Thr Leu Glu Gly Ile Gln Glu Asp Phe Asn Gln Ala Gln Ser Asp Asn Lys  540

1621 GCA GTA TCG TTG GCC GAC CTG ATT GTG CTG GCC GGC TGT GCG GGT GTA GAA AAA GCT GCA 1680
541  Ala Val Ser Leu Ala Asp Leu Ile Val Leu Ala Gly Cys Ala Gly Val Glu Lys Ala Ala  560

1681 AAA GAT GCT GGC CAT GAG GTG CAG GTG CCT TTC AAC CCG GGA CGA GCG GAT GCC ACC GCT 1740
561  Lys Asp Ala Gly His Glu Val Gln Val Pro Phe Asn Pro Gly Arg Ala Asp Ala Thr Ala  580

1741 GAG CAA ACC GAT GTG GAA GCT TTC GAA GCA CTA GAG CCA GCG GCT GAC GGC TTT AGA AAC 1800
581  Glu Gln Thr Asp Val Glu Ala Phe Glu Ala Leu Glu Pro Ala Ala Asp Gly Phe Arg Asn  600

1801 TAC ATT AAA CCG GAG CAT AAA GTA TCC GCT GAG GAA ATG CTC GTA GAC CGG GCG CAG CTT 1860
601  Tyr Ile Lys Pro Glu His Lys Val Ser Ala Glu Glu Met Leu Val Asp Arg Ala Gln Leu  620

1861 CTG TCG CTT TCG GCA CCA GAA ATG ACT GCT TTG GTA GGC GGT ATG CGT GTA CTG GGC ACC 1920
621  Leu Ser Leu Ser Ala Pro Glu Met Thr Ala Leu Val Gly Gly Met Arg Val Leu Gly Thr  640

1921 AAC TAC GAC GGT TCG CAG CAT GGA GTG TTT ACA AAT AAG CCG GGT CAG CTA TCC AAT GAC 1980
641  Asn Tyr Asp Gly Ser Gln His Gly Val Phe Thr Asn Lys Pro Gly Gln Leu Ser Asn Asp  660

1981 TTC TTT GTA AAC CTG CTA GAC CTC AAC ACT AAA TGG CGA GCC AGC GAT GAA TCA GAC AAA 2040
661  Phe Phe Val Asn Leu Leu Asp Leu Asn Thr Lys Trp Arg Ala Ser Asp Glu Ser Asp Lys  680

2041 GTT TTT GAA GGC AGA GAC TTC AAA ACT GGC GAA GTA AAG TGG AGT GGC ACC CGG GTA GAC 2100
681  Val Phe Glu Gly Arg Asp Phe Lys Thr Gly Glu Val Lys Trp Ser Gly Thr Arg Val Asp  700
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FIG. 6D

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2101 CTG ATC TTC GGA TCC AAT TCC GAG CTA AGA GCC CTC GCA GAA GTG TAC GGC TGT GCA GAT 2160
 701 Leu Ile Phe Gly Ser Asn Ser Glu Leu Arg Ala Leu Ala Glu Val Tyr Gly Cys Ala Asp  720

2161 TCT GAA GAA AAG TTT GTT AAA GAT TTT GTG AAG GCC TGG GCC AAA GTA ATG GAC CTG GAC 2220
 721 Ser Glu Glu Lys Phe Val Lys Asp Phe Val Lys Ala Trp Ala Lys Val Met Asp Leu Asp  740

2221 CGG TTT GAT CTG AAA TAA 2238
 741 Arg Phe Asp Leu Lys End  746
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